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ABSTRACT

Presented are results of a study attempting to design a reliable and valid instrument measuring the attitudes of teachers toward energy conservation. A 22-item scale is presented as a result of several administrations to preservice elementary teachers. Items were submitted to Likert Item Analysis and further validated by principle components factor analysis as a means of categorizing items into subscales that could be used to identify specific characteristics of respondents' attitudes toward energy conservation. Tables present sample statements and summary statistical information. (CS)

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Designing a Likert-Type Scale to Assess Attitude Toward Energy Conservation

by

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SE 034 823

Designing a Likert-type Scale
to Assess Attitude Toward Energy Conservation

The Problem

The purpose of this study was to design a reliable and valid instrument to measure the attitudes of preservice elementary school teachers toward energy conservation.

Energy Conservation: The Attitude Construct

Why do some individuals exhibit energy conserving behavior while others having similar cultural background suspect conservation as an unimportant or futile practice? From such behaviors can be abstracted hypothesized traits or characteristics referred to as constructs, presumed to have psychological or educational meaning. The predisposition of the individual to respond favorably or unfavorably toward an attitude object, in this case energy conservation, is generally accepted as the definition of "attitude" (Fishbein and Ajzen, 1975). As a result, the inclination of teachers to express favorable or unfavorable tendencies toward conserving energy could be described as their attitude toward energy conservation.

At the same time that attitudes are enduring predispositions they are also transitional and can be modified by the learning process. If this were not so, it would be futile for educators to operate in the affective domain of learning.

Attitude scales have long been dominated by egocentric, "I believe" statements, which represents but one dimension of the attitude construct. But attitudes are multifaceted. Sherif (1976) emphasizes the social nature of attitudes manifested in the support individuals draw from the norms reference people and reference groups set for others to follow, either

explicitly or implicitly. Statements on attitude scales should represent the sociocentric component of the attitude construct.

A final and important component of attitudes is the action component, statements which imply overt behavior on the part of the respondent. This component is especially important in view of the charge that responses on attitude scales and overt behavior lack consistency. A scale with action statements raises the probability that the responses on an attitude scale better represents actual behavior of the respondent. And a change in behavior mediated by an attitude change is the goal of teachers interested in affective learning.

Therefore, the statements on this scale were designed to represent the three areas, egocentric, sociocentric and action centered as suggested by Hess (1978).

Procedure for Designing the Energy Conservation Attitude Scale

Following closely the rationale and procedure modeled by Shrigley and Trueblood (1979), the following goals were set for designing a scale to measure attitudes toward energy conservation:

(A) A short scale of 20-25 statements requiring only 10-15 minutes to administer

(B) A representative sampling of positive and negative statements

(C) Statements meeting the 13 criteria developed by Edwards (1957)

(D) Statements general enough that they might be used with many target populations

(E) Statements validated by a minimum item-total correlation coefficient (adjusted) of .30

(F) A scale with a minimum coefficient alpha of .80

Designing the Statements

The investigator wrote 41 statements related to energy conservation and administered them to several groups of preservice elementary teachers. The data were submitted to a Likert analysis for the purpose of eliminating neutral statements, those that most respondents agreed or disagreed with. Statements not reaching the item-total correlation r-value of .30 were either revised or dropped.

As shown on Table I, most of the final statements meet all of Edwards' (1957) criteria. Table II classifies the statements into the ego, socio and action-centered components as categorized by the investigator. Negative statements are vulnerable to the Likert analysis so more of the negative ones failed to reach statistical criterion. The scale has 15 positive and 7 negative statements instead of the recommended equal number of each.

The Factor Analysis

The final generation of items was administered to 102 preservice elementary and special education teachers enrolled at an eastern university. To further validate the scale, the data were subjected to a principal components factor analysis. A three factor solution was chosen for the purpose of checking the investigator's classification of items in the egocentric, sociometric and action-centered categories.

A varimax rotation resulted in items loading on each of the three factors. The analysis accounted for 69.3 percent of the total variance with 15.1 percent attributed to Factor I, 23.8 percent to Factor II and 30.4 percent to Factor III.

Table I: Statements of the Kobalia Instrument
Checked Against Edward's Criteria for Likert Scales

Scoring Key	Points Pos	Points Neg
Strongly Agree	5	1
Agree	4	2
Undecided	3	3
Disagree	2	4
Strongly Disagree	1	5

	Does not refer to the past	Cannot be interpreted as factual.	Cannot be interpreted in several ways	Is relevant to psychological object	Not endorsed by everyone or no one	Language simple, clear and direct	Does not exceed 20 words	Contains only one complete thought	"All," "always," "none" and "never" avoided	"Only," "just," and "merely" used with care	Simple sentences prefered	Avoid words population might not understand	Avoid use of double negatives	Table II: Statements Categorized According to the Three Components of the Attitude Construct: Egocentric	Sociocentric	Action Centered
1) I fail to understand why energy conservation is necessary. N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
2) In my opinion, energy conservation is unnecessary. N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
3) I favor the conservation of energy. P	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
4) To me, it makes more sense to conserve energy than not to. P	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
5) I disfavor energy conservation. N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
6) The schools should tool up immediately to teach practices of energy conservation. P	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
7) The economic health of our country depends upon our ability to conserve energy. P	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
8) Effective energy conservation programs will increase economic growth. P	X	X	X	X	X	X	X	X	X	X	X	X	X			X
9) Energy conservation is the responsibility of all citizens. P	X	X	X	X	X	X	X	X	X	X	X	X	X			X
10) I ignore the urgency of energy conservation when I travel by car. N	X	X	X	X	X	X	X	X	X	X	X	X	X			X
11) I would not buy a car that gets less than 30 miles per gallon of gasoline. P	X	X	X	X	X	X	X	X	X	X	X	X	X			X
12) To conserve energy, I observe posted speed limits when I am driving. P	X	X	X	X	X	X	X	X	X	X		X	X			X
13) I will not participate in night sports that require the excessive use of lights. P	X	X	X	X	X	X	X	X	X	X	X	X	X			X
14) My efforts to conserve energy are not worth the time it takes to accomplish them. N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
15) I enjoy discussing ways of conserving energy with my friends. P	X	X	X	X	X	X	X	X	X	X	X	X	X			X
16) I practice energy conservation on a daily basis. P	X	X	X	X	X	X	X	X	X	X	X	X	X			X
17) The need to conserve energy does not exist. N	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
18) Conservation is presently a plausible alternative to the energy problem confronting us. P	X	X	X	X	X	X	X	X	X	X		X	X		X	
19) Energy efficiency influences me when purchasing an electrical appliance. P	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
20) An additional tax should be imposed on the purchase of those appliances that use excessive amounts of energy. P	X	X	X	X	X	X	X	X	X	X		X	X		X	
21) During the winter months, I would refuse to wear a sweater for several hours per day. N	X	X	X	X	X	X	X	X	X	X		X	X	X		
22) Entertainment establishments should be closed at 11:00 p.m. in an effort to conserve energy. P	X	X	X	X	X	X	X	X	X	X	X	X	X		X	

Table III: Summary of Factor Analysis and Likert Item Analysis
n = 102

Factor Analysis Data							Likert Item Analysis	
			Factor Loadings				Adj Item-Total Correlation	
Item #	$\bar{x}$	S.D.	I	II	III	Factor Assign	Total Score	Subscales Combined
1	4.50	.76	.57	-.00	.11	I	.23	.34
2	4.68	.48	.71	.11	.08	I	.40	.54
3	4.63	.53	.72	-.13	-.13	I	.55	.61
4	4.63	.55	.72	-.17	-.06	I	.48	.54
5	4.55	.51	.81	.03	-.21	I	.62	.74
6	4.19	.75	.34	.13	.61	III	.46	.56
7	4.10	.79	.10	-.03	-.69	III	.46	.48
8	3.62	.75	-.02	-.02	-.60	III	.34	.32
9	4.47	.62	.35	-.10	-.55	III	.57	.58
10	3.34	.99	-.01	-.01	-.55	III	.38	.24
11	3.12	1.12	.04	-.15	.17	—	.55	—
12	3.61	1.00	.09	-.39	-.07	—	.45	—
13	2.39	.87	.16	-.28	-.08	—	.46	—
14	3.98	.64	-.10	-.20	-.20	—	.38	—
15	2.81	.88	.29	-.42	-.00	—	.42	
16	3.42	.89	.16	-.40	-.06	—	.37	—
17	4.57	.55	.01	-.64	.02	II	.50	.62
18	2.98	.98	.05	-.50	-.31	II	.38	.35
19	3.05	1.02	.03	-.51	-.31	II	.59	.47
20	2.79	1.03	.24	-.58	.00	II	.33	.35
21	4.01	.88	.70	.00	-.18	I	.28	.33
22	2.27	.97	.23	-.49	-.36	—	.34	—
			Mean				81.77	60.17
			Standard Deviation				8.26	5.62
			Average Inter-Item Correlation				.17	.18
			Coefficient Alpha				.82	.77

Table IV: Likert Item Analysis Data on Subscales
n = 102

Factor	Subscale Label	Item No.	Pos Neg	Mean	S.D.	Item Total Correlation	Coefficient Alpha
I	Egocentric	1	N	27.03	2.49	.51	.73
		2	N			.77	
		3	P			.67	
		4	P			.64	
		5	N			.83	
		21	N			.25	
II	Sociocentric	17	N	13.39	2.24	.45	.44
		18	P			.33	
		19	P			.56	
		20	P			.56	
III	Action	6	P	19.75	2.27	.70	.52
	Centered	7	P			.63	
		8	P			.39	
		9	P			.65	
		10	N			.39	

Correlation of Subscales I and II .43
I and III .39
II and III .58

Table III presents item summary statistics with the statements of the attitude scale in the same order as shown on Table I. For statements to reach criterion, the data on an item had to have:

(1) A factor loading of 0.50 or higher on one factor, and

(2) A loading of 0.40 or lower on the other two factors

Items 11, 12, 13, 14, 15, 16 and 22 did not reach criterion. Therefore, the investigator did not include them as a part of the three subscales. (See Table III.)

Likert Analysis of the Statements

1. Analysis of Total Scale. Items No. 1 and No. 21 failed to reach a minimum item-total correlation coefficient r-value of .30. The investigator suggests that the r-value may rise as the need to conserve energy becomes more acute. The coefficient alpha was .82 and the average inter-item correlation coefficient r-value of the 22 statements was .17.

2. Analysis of Three Subscales. An independent Likert Analysis of each of the three subscales was administered and the results are shown on Table IV. Also provided is the investigator's subscale classification of each item. Fifteen of the 22 statements grouped around the three classifications, egocentric, sociocentric and action-centered. With the exception of No. 10, the item-total correlation coefficient r-value of each of the 15 statements was higher than the recommended .30. The coefficient alpha of Factor I was .73; Factor II, .44; and Factor III, .52. The r-values below the recommended .80 may be a function of group size. However, the r-values of Factors II and III suggest that these two subscales could not at the moment serve as independent attitude scales for researchers interested in only the sociocentric or action-centered components.

Recommended Modification and Use of the Scale

1. The Edwards' content validity check, as well as the results of the Likert analysis, suggests that all 22 statements could be used as a scale to test the effects of treatment in attitude research.

2. For the researcher interested in a shorter scale, one that speaks specifically to the three subcomponents of the attitude construct, the egocentric, sociocentric and action-centered, combining the three subscales into a 15 statement scale is recommended.

3. Each of the three subscales could be developed into independent attitude scales for researchers interested in emphasizing subcomponents of the attitude construct. At the moment, however, the alphas are low, especially on the sociocentric and action-centered components. Adding two or three valid and reliable statements to each of those components would probably raise the coefficient alphas. This would mean administering the items, the old and the new, to samples of preservice teachers and subjecting the data again to the Likert and factor analyses.

If all the new statements were negative ones, the negative-positive proportions of the total scale could be better balanced. Because negatively-worded statements are vulnerable to the Likert analysis, adding five or six new negative statements would probably mean beginning with 15 or more.

4. Because none of the statements refer specifically to teachers or the classroom, the scale should be considered to test populations outside the target group of this study. The investigator recommends that in its present form populations including 14 years of age and older could be tested. Researchers using it with younger individuals would be wise to submit the statements to a readability level test.

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